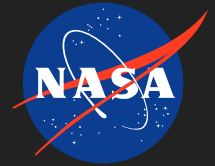


Lithium Ion Batteries Development for CubeSats and SmallSats

Completed Technology Project (2014 - 2016)



Project Introduction

Lithium Ion (Li-Ion) cells are being developed for high-power batteries in space; especially there is a strong need to miniaturize Li-Ion batteries for CubeSat and SmallSat. For this reason, we propose a process to design and implement Goddard Space Flight Center (GSFC) in-house Li-Ion battery pack which provides us control over testing to design a high quality battery pack with low cost, risk reduction, and being able to adapt interface and mechanical form factor.

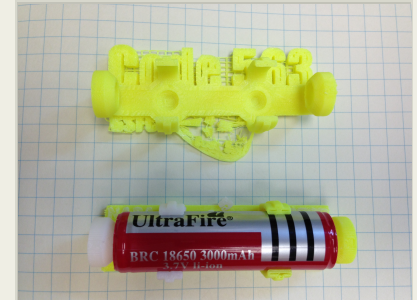
Goddard scientists and engineers are developing SmallSat for the Center's and NASA's mission needs. The Goddard in-house Smallsat Li-Ion design address capabilities for NASA's missions in science, exploration and space operation. This technology development includes two processes: Characterize Li-Ion cells and design battery pack as following:

- a. Characterize Li-Ion cells: Contact Li-Ion cells from vendors authorized distributors to procure Li-Ion cells with two common sizes 18650 (18 mm x 65 mm) and 16340 (16 mm x 34 mm). We simply order sufficient quantity of commercial-of-the-shelf (COTS) cells. We will test for safety and performance at cell level. Cell level testing includes studies of the cell physical design, rate performance, cycle lifetime, self-discharge, thermal properties, Lot Acceptance Tests (LAT) for electrical properties, capacity verification, degradation, impedance matching, and mission profile. The test results will be used as our own Li-Ion cells database which in turn will be used to design a flight battery pack for CubeSat or SmallSat.
- b. Design a battery: As part of this task we will investigate and trade the protection features to either already built-in within the cells or included in the overall battery pack. The protection features to consider include short circuit, over-charging, over-discharging, and to maintain battery temperature.

Anticipated Benefits

Goddard Modular Smallsat Architecture (GMSA)

Cubesat and Smallsat.



Code 563 3D-printer

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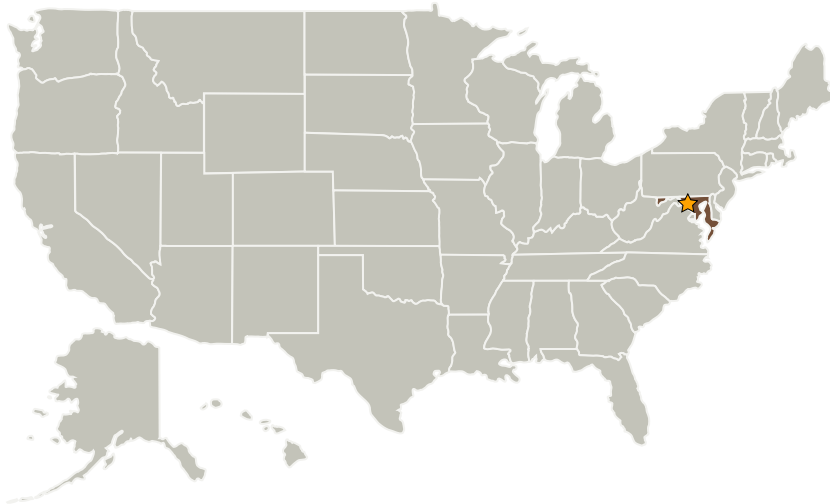
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Lithium Ion Batteries Development for CubeSats and SmallSats

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Goddard Space Flight Center (GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

Wesley A Powell

Principal Investigator:

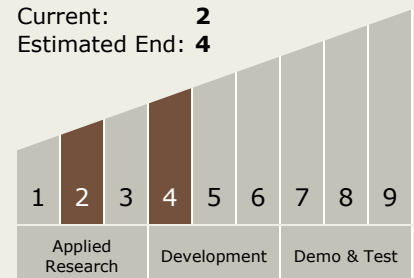
Hanson C Nguyen

Technology Maturity (TRL)

Start: 2

Current: 2

Estimated End: 4





Images



3D-Printer battery housing for single cell

Code 563 3D-printer
(<https://techport.nasa.gov/image/4182>)



Figure 2: Thermal Chambers in our lab

Five thermal chambers in our battery lab

Five thermal chambers in our lab allow us full capability to test Li-ion cells
(<https://techport.nasa.gov/image/4183>)

Links

1434465051
(no url provided)

Project Website:

<http://aetd.gsfc.nasa.gov>

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.2 Energy Storage
 - └ TX03.2.1 Electrochemical: Batteries